I have not tried the effect of electro-depositing platinum upon it as a means of roughening the surface of platinum foil; but experiments with clean platinum in sulphuric acid, and with clean platinum in strong solution of caustic potash, and again with iron-wire gauze, and even with iron-wire gauze spread with fine iron-filings, in the latter liquid, as supports for the layer of dioxide, sufficiently evinced that mechanical roughness alone is quite unproductive of the close intimacy of contact between the peroxide and the metal plate required to establish the necessary kind of rheomotive continuity between them. But on the other hand, if iron in caustic potash could by any means be brought superficially (perhaps by kilning it in oxide of manganese) to as intimate conjunction during the charging process with lead peroxide, as platinum-foil is brought by a preparatory coking of its surface, it would be an equally effective and equally indestructible substitute for a lead plate with platinum, and as far as I have observed it, as retentive an accumulator of the charge communicated to it as platinum itself is either in dilute acid or in caustic potash.

But on an iron conductor in a solution of caustic alkali, dioxide of lead itself must be originally spread out; since this liquid seems incapable (at least without protracted action), although it soon forms the spongy-lead layer opposite to it, of converting the minium into a dioxide layer. The electrolysis of water by iron electrodes in a solution of caustic soda and of caustic potash, also, is singularly rapid, attended perhaps by a minimum counter-force of polarisation, and by little production of ozone, so that the proportion of oxygen absorbed to the oxygen wasted and given off in charging,[1] unless a weak current only is applied, is less than with dilute sulphuric acid, and the liquid has an inconvenient tendency to froth up. But in regard to storage and retention of a charge communicated to it, and in its manner of furnishing the return or secondary current, this arrangement appears to be just as efficacious as one with a clean platinum conductor.

A cell made with minium laid on two clean platinum-leaves of a pair of ordinary pint Grove-cells, weighed when placed with acid in its glass jar (not much larger than a glove's thumb- or finger-stall), just seven ounces. Yet when well charged it rang a call-bell continuously for eight hours. When afterwards re-charged, and washed, and left to dry unavoidably for a fortnight, on simply immersing it then in a solution of caustic potash, it rang a bell with a few intervals of intermittence of the current, for twenty hours before it was exhausted. It still continues with similar intermittences of a few day's rest to furnish residual bell-ringing currents of two or three hours' duration each, sufficiently proving the extreme hardiness and retentiveness of its construction. A rather bulkier cell formed with two coated sheets of iron-wire gauze in caustic potash comported itself in an exactly similar manner, having just now, five days after being charged, and without yet ceasing its clatter, rung a bell continuously for thirty-six hours.[2]

But between these small messenger-currents and the substantial stream that can be drawn from a properly-formed Planté or Faure cell with lead-plates of the same size, there is as much difference as between a caged song-bird and a slipped falcon; and it has afforded me extreme pleasure to be able to reproduce successfully the normal action of the lead accumulators with an indestructible metal plate as the negative conductor, by the fortunate possession and trial of a piece of platinum-foil roughened in the way described above, which was accidentally preserved from some former experiments on mossy incrustations produced on platinum surfaces by contact with carbon or with heated vapours in a carbonising kiln.

Although already convinced of its correctness by these experiments, I owed to the pages (pp. 382-83) of Prof. Silvanus Thompson's excellent book of "Elementary Lessons in Electricity and Magnetism" which treat of secondary batteries, my first acquaintance with the general acceptance as an established fact of the view that gaseous polarisation of the plates by oxygen and hydrogen is in these extreme, as much as in ordinary weaker cases, the source of the secondary or return current in a secondary cell—that, for example, in Planté's cells the lead-plates acquire their high tension by "becoming with use coated with a semi-porous film of brown dioxide of lead, presenting a large amount of surface and holding the gases well"; and that by Faure's method of preparation, the improvement is effected that "cells thus prepared sooner acquire the effective spongy brown surface of dioxide of lead."

It is, in fact, a well-known result, and one which I can thoroughly confirm from the tests and observations to which I have submitted it, that whatever electromotive force the simple contact of dioxide of lead by itself may be sufficiently energetic to produce,[1] it is to a natural aptitude which it possesses besides for occluding ozone or nascent electrolytic oxygen in its pores, and probably also by undergoing at the same time chemical superoxydation, to which its remarkably high tension and effective electromotive deportment in secondary cells must really be ascribed. It is thus that a platinum cathode, by occluding electrolytic hydrogen in its substance, becomes electropositive, and that palladium similarly charged to repletion with hydrogen by electrolysis, even becomes at last spontaneously inflammable.

In Dr. Gore's treatise in the "Circle of the Sciences" on "Electro-Deposition," it is mentioned (pp. 55, 56) that in rapid negative depositions of antimony, the freshly-deposited metal is explosive to such a degree, with evolution of heat and of a cloud of white vapour at points where it is rubbed, that thickly plated articles are sometimes liable to sudden fractures and destruction by this accident, if incautiously handled, even for some hours after they are washed and dried. Either the storage of nascent hydrogen in the antimony, it is supposed, or of an unstable molecular form of antimony itself, is here effected also by the galvanic current; and ozone is a form of oxygen which is only producible by similar means of exciting and provoking molecular accumulation or storage of energy.

The absorbed oxygen's state in the peroxide film would seem to be, as that of occluded hydrogen has appeared to be in metals, one of easy dissociation from, joined and consorted to physical admixture with, some precarious chemical oxide or compound depending, as it seems reasonable to suppose, for its existence in some degree upon the quantity of its free materials present in the substance with it. But the freedom with which the gases are able to diffuse themselves everywhere through the film or metal, is no doubt a sufficient and suitably adequate condition to maintain the precarious compound's chemical integrity, so as to make it a retentive source of energy, as long as the uncombined gas-portions with which it is surrounded in the film or metal, are not withdrawn from it by a galvanic discharge arising from completion either of the secondary circuit or else of some unavoidable channels of destructive local actions.

The contact theory of current excitation requires such close linkage together of circuit elements, for the establishment of a current through them, that if the highly negative peroxide-film should be severed by liquid, or by any substance equally inert to a liquid in the voltaic chain, from its metal plate conductor, its effective electromotive force would immediately disappear from the circuit. This is the ground on which I surmised the need, above, of such a perfect contact between the peroxide film and its metal carrier that only a molecular union produced between them in the charging process could well be expected to prevent the intrusion of the liquid of the cell, to the current's detriment, between the actively electromotive gas-absorbing layer and its adjoining inoperative metal-plate conductor, or battery-connection.

It is, again, to the hints contained in a paragraph on a later page (p. 391) of Prof. Silvanus Thompson's book, describing the phenomena and the modes of producing Nobili's rings, that I owe the suggestion of trying the experiment of iron-gauze electrodes in solution of caustic alkalies, which produced a very satisfactory form of secondary cell, showing at least a possibility of perhaps effecting in it some future practical improvements.

A. S. HERSCHEL

College of Physical Science, Newcastle-on-Tyne, March 20

[1] See Drs. Gladstone and Tribe's experiments and remarks on the relative absorptions and losses of the electrolysed gases in charging a lead-cell; "The Chemistry of the Planté and Faure Accumulators," Part II.; NATURE, xxv. p. 462.

[2] This cell's current lasted forty hours; but a week later a residual current of two more hours' duration was extracted from it.

Aristotle on the Heart

ALLOW me space to say, in reference to Dr. Richardson's letter in NATURE, vol. xxv. p. 505, that my note on Aristotle's account of the heart, though so lately published, was written many years ago, and therefore in complete independence of Prof. Huxley's article on the same subject. This fact, of course, in no way lessens Prof. Huxley's complete rights of priority; but I

[1] This was shown by F. Munck, in *Poggendorff's Annalen* (*circa*, 1835), to surpass negatively that of all the other metallic oxides, not excepting the black oxide of manganese, by means of the usual contact experiments with a gold-leaf electroscope and condenser.

am anxious to state it, in order to clear myself of any suspicion of having borrowed from that distinguished writer without acknowledgment. W. OGLE

April 2

Rime Cloud observed in a Balloon

IN his letter, inserted in NATURE, vol. xxv. p. 507, Dr. Hermann Kopp says that "when Kratzenstein (1744) advocated the opinion anticipated by Halley (1686), that water-vapour may be condensed in a vesicular state, he availed himself of the *observation that in clouds and mists and condensed steam over boiling water, a rainbow is not to be observed in reflected light.*" I have good grounds to suppose these negative observations were made only because the intensity of reflected light was not sufficient, as a white rainbow is produced under these circumstances. In support of these assumptions, I may be allowed to quote an observation published by M. Faye in vol. xxviii. of the *Comptes rendus*, 1849, p. 244, where the celebrated astronomer says :—

"J'ai observé cette nuit un phénomène que je signale aux personnes qui l'occupent d'optique météorologique. En sortant d'une salle de travail qui donne sur le parc de l'observatoire, j'ai remarqué que la lumière d'un bec de gaz en arrière produisait en face de moi par la porte entrouverte un arc-en-ciel blanc semblable à un halo lunaire . . . Cet arc-en-ciel blanc doit être aisement réproduit par les temps de brouillards ; ou pourrait le faire naître a la lumière électrique . . . et l'étudier plus complétement que je ne l'ai fait."

It is to be regretted that the suggestion of the illustrious astronomer has not been taken into account by the physicists in an age when the electric light is so frequently in their hands. I believe that this kind of experimentation will elucidate the controversy, and afford some new ideas on the constitution of clouds under several circumstances, as artificial clouds may be produced by using jets of steam or condensing steam over a boiler. I believe a white rainbow, which is really the corona of the aëronauts, would appear under these circumstances, and the phenomenon would take another aspect when electric light falls on solid snow. The electric lighthouses now building will afford to the keepers many opportunities of making this observation. I take advantage of this opportunity to ask M. Hermann Kopp if he will obligingly suggest some observations to be made in a balloon for examining whether the minute particles of water are liquid or solid. By doing so, he will confer a great benefit on aëronauts next winter. W. DE FONVIELLE

The Kunnungs

HAVING just returned from an exploring expedition east of Asam, where I met a number of "Kunnungs," I may report that they appear distinct, both in language and physique, to the Naga groups south of Asam, and, in language, have affinities with Singphos. Those I saw, were with one exception, much more prepossessing in appearance than the other hill-savages, and in colour very pale, *i.e.* 33 and 45 of Broca's scale. I have got a limited vocabulary. They are great iron and steel workers, and extend from the Mli-kha to what they call the boundary of China, living on pile platform dwellings, raiding like all the hill-men about, having "morongs," or separate houses for the unmarried ; like others, also, their "morals" (as we should say) begin with marriage.

I am now preparing some notes of my trip, and send this as I am writing, as it may interest some to know whom these people seem like. S. E. PEAL

Subsagar, Asam

Burrowing Larvæ

IN his letter *ante* p. 265, Dr. Hagen states that he had "been informed by M. Lesquereux that a large number of magnolia leaves, from the Tertiary of Alaska, show serpentine trails not larger than a thread, running all over the leaves, apparently under the epithelium," and Dr. Hagen evidently believes them to be the mines or burrows of some Tineid larvæ. Precisely such mines are now made in this country, in the leaves of magnolias, by a larva of the genus *Phyllocnistis*, Zell. The moth has not been bred from the larvæ, but the mine and larvæ are indistinguishable from those made by *Phyllocnistis liriodendronella*, Clem., in leaves of *Liriodendron tulipifera*, and doubtless it is the same species in both of these allied trees. "What is a species?" however, is a doubtful question in *Phyllocnistis*, at least in our American species. No species of this or any other genus is known to burrow in the leaves of any of the other genera of plants named in Dr. Hagen's letter besides Magnolia, Liquidambar, and Sassifras. Another *Phyllocnistis* mines the leaves of Liquidambar, and has been described by me under the name of *P. liquidambar-isella*, but it is probably identical with *P. vitifoliella*, Cham. The mine is similar to, but distinct from, that of *P. liriodendronella*. The larva which mines Sassafras leaves is that of *Gracilaria sassafracella*, Cham., but it leaves the mine at a very early stage of larval life, when the mine is too small to be recognised in a fossil leaf, unless it has been unusually well preserved. In this connection I will add that I distinctly remember having *somewhere* seen a figure, by Lesquereux I think, of a fossil leaf of a species of *Acer*, on which there were several blotches, one of which bore a strong resemblance to the mine of *Lithocolletis aceriella*, now made in leaves of *Acer saccharinum ;* but as I saw only the figure, and not the fossil, I cannot be certain that it was a mine of that larva.

Covington, Ky., U.S.A., March 10 V. T. CHAMBERS

Vignettes from Nature

WILL Dr. W. B. Carpenter kindly tell us where in "South America" are the "coprolite diggings" from which he had "just seen a collection of sharks' teeth"? I am aware that at Bull River, South Carolina, North America, are vast deposits of "coprolites" (almost identical in character with those of our Suffolk Cray), which are largely imported into England from the United States. Of these Bull River sharks' teeth, &c., I have had many specimens. W. BUDDEN

Ipswich, March 23

Red Flints in the Chalk

AT one part of Caterham Valley, Surrey, there is an example of an abundance of red flints similar to that mentioned by W. Fream (NATURE, vol. xxv. p. 437). The colour is, doubtless, due to the presence of oxide of iron, but I have not tested it. I find that the red flints invariably contain the remains of sponges, the network of spiculæ of which, being coated with the oxide of iron, show up in crimson or orange on a ground of black flint, and are very beautiful objects under a lens. Thus it appears to me that the redness observable in these flints is mostly due to the inclosure of sponges which contain either oxide of iron or iron which afterwards became oxidised. The yellow oxide of iron is disseminated throughout the *chalk* itself, some strata being very much stained by it. JOHN BADCOCK, Jun.

270, Victoria Park Road, E.

ON THE DISPERSAL OF FRESHWATER BIVALVES

THE wide distribution of the same species, and of closely-allied species of freshwater shells must have surprised every one who has attended to this subject. A naturalist, when he collects for the first time freshwater animals in a distant region, is astonished at their general similarity to those of his native European home, in comparison with the surrounding terrestrial animals and plants. Hence I was led to publish in NATURE (vol. xviii. p. 120) a letter to me from Mr. A. H. Gray, of Danversport, Massachusetts, in which he gives a drawing of a living shell of *Unio complanatus*, attached to the tip of the middle toe of a duck (*Querquedula discors*) shot on the wing. The toe had been pinched so hard by the shell that it was indented and abraded. If the bird had not been killed, it would have alighted on some pool, and the Unio would no doubt sooner or later have relaxed its hold and dropped off. It is not likely that such cases should often be observed, for a bird when shot would generally fall on the ground so heavily that an attached shell would be shaken off and overlooked.

I am now able to add, through the kindness of Mr. W. D. Crick, of Northampton, another and different case. On February 18 of the present year, he caught a female *Dytiscus marginalis*, with a shell of *Cyclas cornea* clinging to the tarsus of its middle leg. The shell was ·45 of an inch from end to end, ·3 in depth, and weighed (as Mr. Crick informs me) ·39 grams, or 6 grains. The valves